CLAIMS

What is claimed is:

1. A method for annealing a layer of material having a high dielectric constant (high-k) formed over a semiconductor substrate, comprising:

introducing an ambient comprising hydrogen, nitrogen and an oxidizer to the substrate and layer of high-k material; and

heating the high-k dielectric layer to a temperature greater than 700 degrees Celsius while the gate dielectric layer is in the ambient, the ambient mitigating the formation of lower dielectric constant (lower-k) material between the high-k gate dielectric layer and the substrate.

2. The method of claim 1, wherein the ambient comprises ammonia (NH_3) and the oxidizer.

3. The method of claim 2, wherein the oxidizer includes at least one of O, N_2O, NO and H_2O.

4. The method of claim 2, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 200 Torr.

5. The method of claim 2, further comprising heating the high-k dielectric layer to between about 700 to 1300 degrees Celsius.

6. The method of claim 2, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 20 Torr.

7. The method of claim 2, wherein the ammonia is initially introduced to the high-k material followed by the oxidizer to mitigate the likelihood of crystallization of the high-k material.

8. The method of claim 2, wherein a greater concentration of the oxidizer is included in the ambient when nitrogen is pre-existing within the high-k material.

9. The method of claim 2, further comprising:

adding argon to the ambient to broaden an acceptable temperature range.

10. A method for annealing a high dielectric constant (high-k) gate dielectric layer, comprising:

placing a wafer including one or more partially formed transistors in an ambient comprising hydrogen, nitrogen and an oxidizer, respective transistors comprising a high-k gate dielectric layer formed over a substrate; and

heating the high-k gate dielectric layer to a temperature greater than 700 degrees Celsius while the gate dielectric layer is in the ambient, the ambient mitigating the formation of lower dielectric constant (lower-k) material between the high-k gate dielectric layer and the substrate.

11. The method of claim 10, wherein the ambient comprises ammonia (NH_3) and the oxidizer.

12. The method of claim 11, wherein the oxidizer includes at least one of O, N_2O, NO and H_2O.

13. The method of claim 11, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 200 Torr.

14. The method of claim 11, further comprising heating the high-k dielectric layer to between about 700 to 1300 degrees Celsius.

15. The method of claim 11, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 20 Torr.

16. A method for fabricating a transistor having a high dielectric constant (high-k) gate dielectric layer, comprising:

forming a high-k gate dielectric layer on a substrate; and

annealing the substrate and high-k gate dielectric layer,

the annealing comprising:

introducing an ambient comprising hydrogen, nitrogen and an oxidizer to the substrate and high-k gate dielectric layer;

heating the high-k dielectric layer to a temperature greater than 700 degrees Celsius while the gate dielectric layer is in the ambient, the ambient mitigating the formation of lower dielectric constant (lower-k) material between the high-k gate dielectric layer and the substrate.

17. The method of claim 16, wherein the ambient comprises ammonia (NH_3) and the oxidizer.

18. The method of claim 17, wherein the oxidizer includes at least one of O, N_2O, NO and H_2O.

19. The method of claim 17, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 200 Torr.

20. The method of claim 17, further comprising heating the high-k dielectric layer to between about 700 to 1300 degrees Celsius.

21. The method of claim 17, further comprising:

maintaining the high-k dielectric layer and ambient under a pressure of about 20 Torr.